## FIG. 1

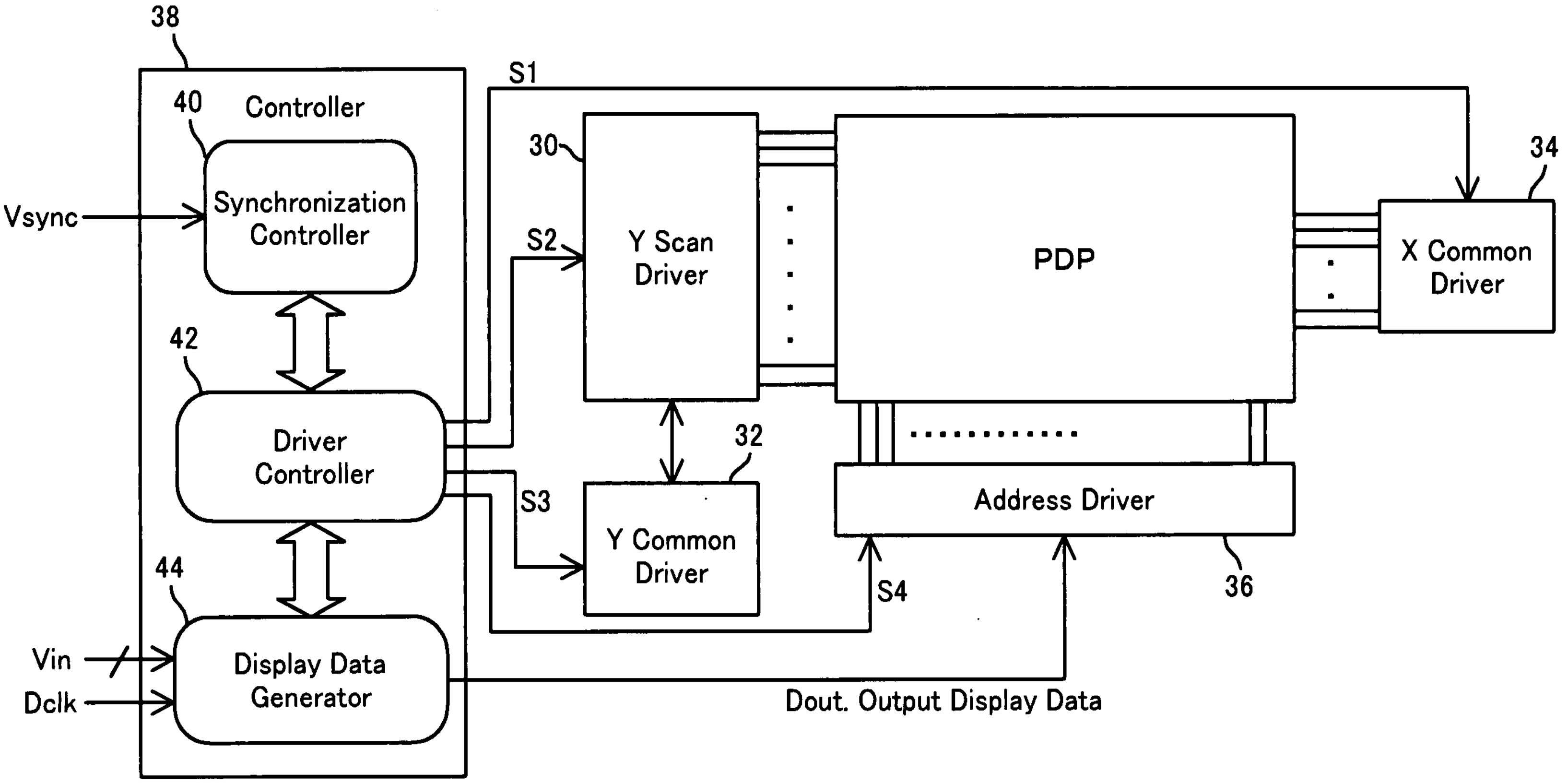

38
40
Controller
Synchronization Controller
Vsync
42
Driver Controller
44
Display Data Generator
Vin
Dclk
S1
30
S2
Y Scan Driver
32
Y Common Driver
S3
PDP
34
X Common Driver
Address Driver
36
S4
Dout. Output Display Data

FIG. 2

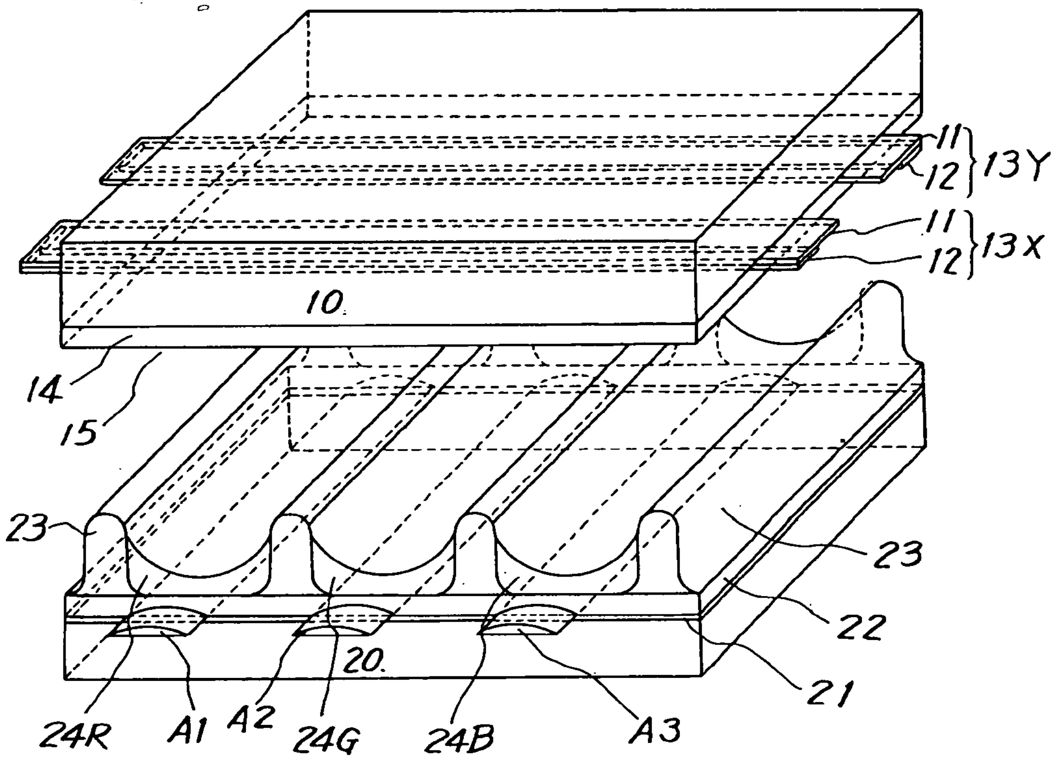


FIG. 3

Sub-frame System of Embodiment (8 + 1 Sub-frames)

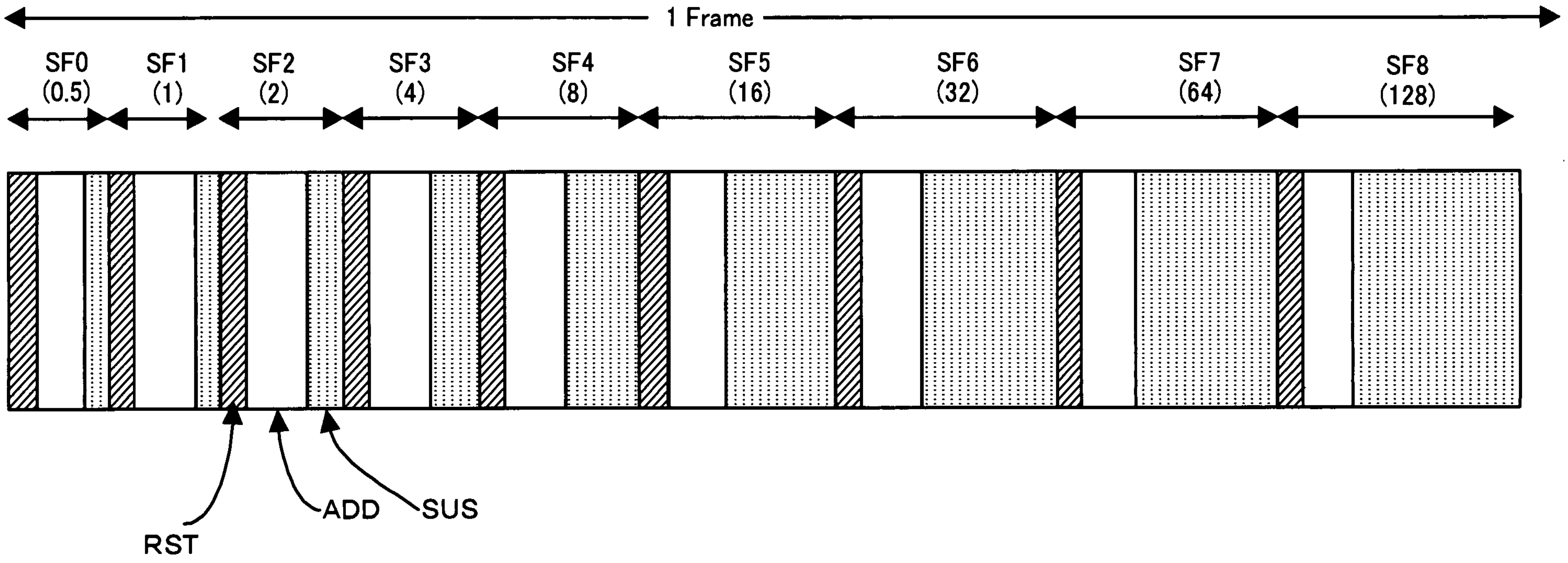


FIG. 4

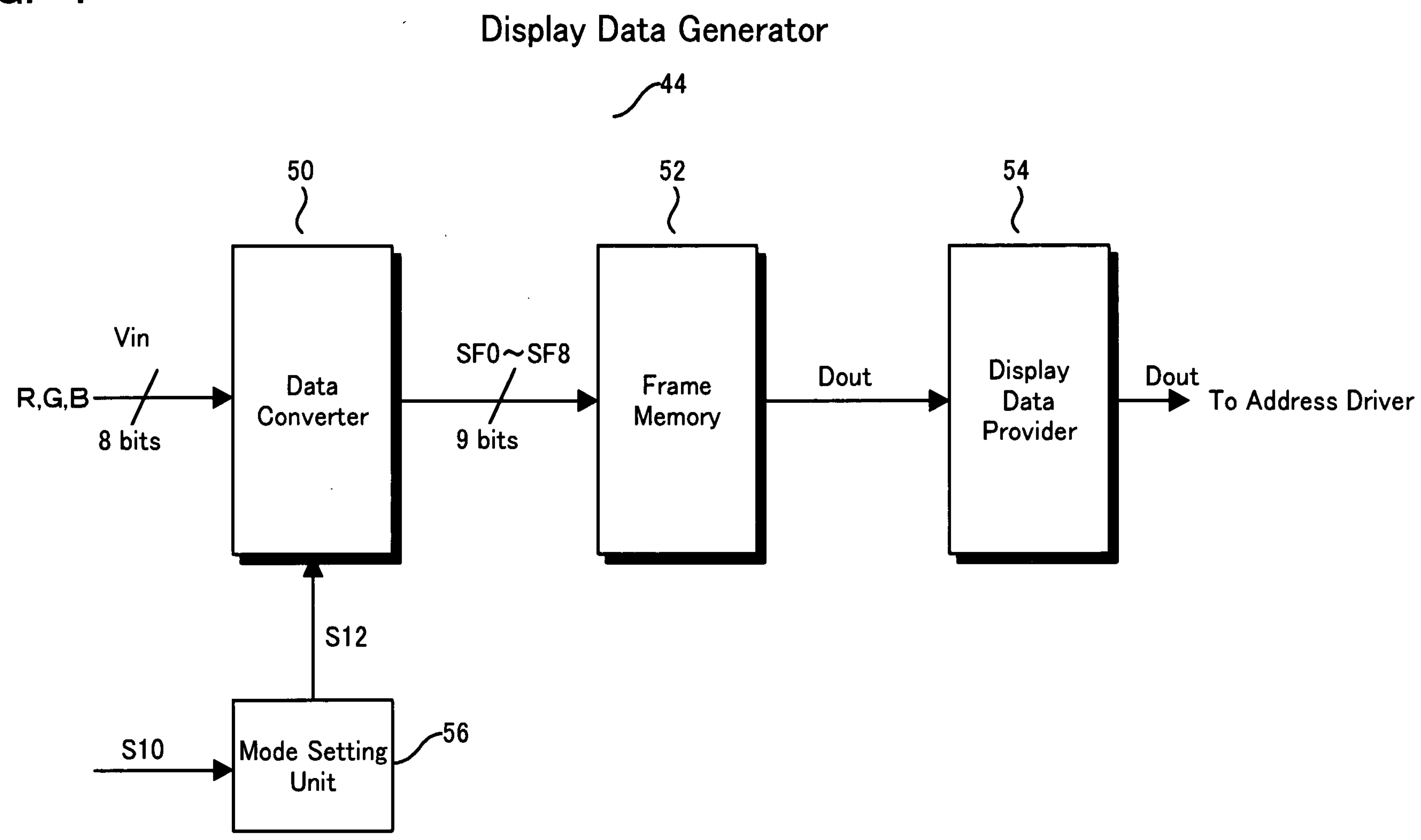
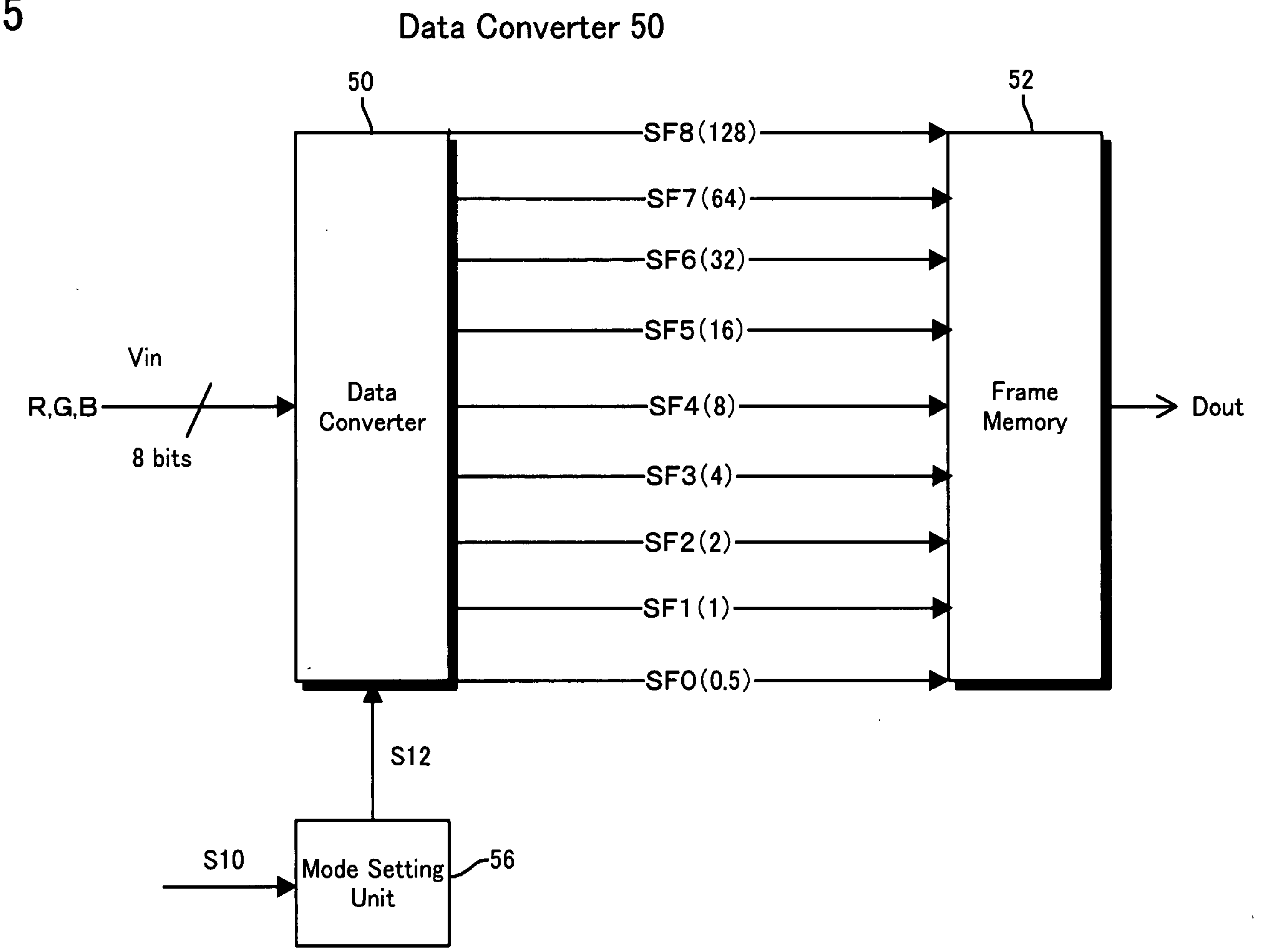
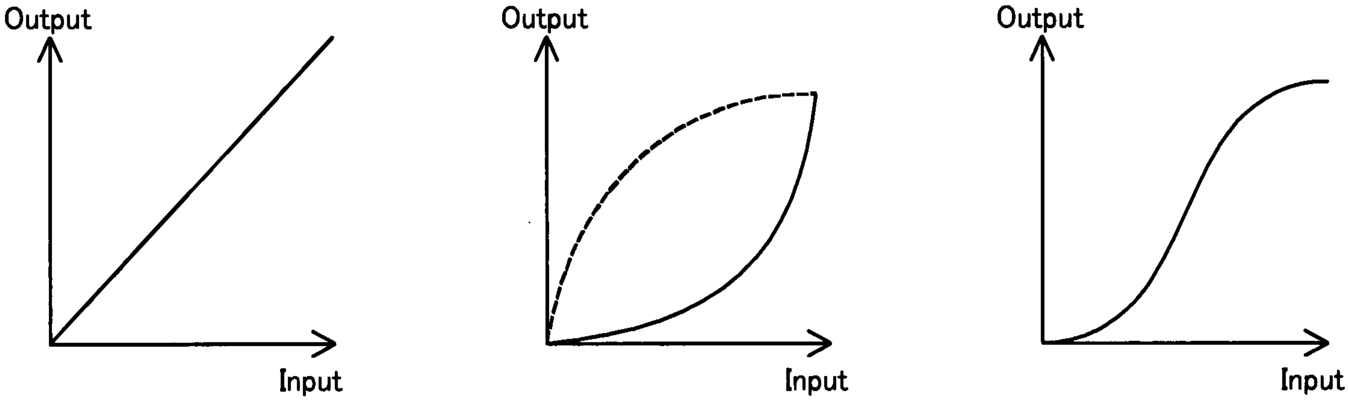

Display Data Generator
44
50
52
54
Vin
R,G,B
8 bits
Data Converter
SF0～SF8
9 bits
Frame Memory
Dout
Display Data Provider
Dout
To Address Driver
S12
S10
Mode Setting Unit
56

FIG. 5


Data Converter 50
50
52
Vin
R,G,B
8 bits
Data Converter
SF8(128)
SF7(64)
SF6(32)
SF5(16)
SF4(8)
SF3(4)
SF2(2)
SF1(1)
SF0(0.5)
Frame Memory
Dout
S12
S10
Mode Setting Unit
56

Characteristics of Conversion Table

FIG. 6A FIG. 6B FIG. 6C



Linear $\gamma$ S

FIG. 7

Conversion Table (1)

| Input Gray Scale | SF0 (0.5) | SF1 (1) | SF2 (2) | SF3 (4) | SF4 (8) | SF5 (16) | SF6 (32) | SF7 (64) | SF8 (128) | Luminance |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | 0 |
| 1 | 1 | | | | | | | | | 0.5 |
| 2 | | 1 | | | | | | | | 1.0 |
| 3 | 1 | 1 | | | | | | | | 1.5 |
| 4 | | | 1 | | | | | | | 2.0 |
| 5 | 1 | | 1 | | | | | | | 2.5 |
| 6 | | 1 | 1 | | | | | | | 3.0 |
| 7 | 1 | 1 | 1 | | | | | | | 3.5 |
| 8 | | | | 1 | | | | | | 4.0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 121 | 1 | | | 1 | 1 | 1 | 1 | | | 60.5 |
| 122 | | 1 | | 1 | 1 | 1 | 1 | | | 61.0 |
| 123 | 1 | 1 | | 1 | 1 | 1 | 1 | | | 61.5 |
| 124 | | | 1 | 1 | 1 | 1 | 1 | | | 62.0 |
| 125 | 1 | | 1 | 1 | 1 | 1 | 1 | | | 62.5 |
| 126 | | 1 | 1 | 1 | 1 | 1 | 1 | | | 63.0 |
| 127 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | 63.5 |
| 128 | | | | | | | | 1 | | 64 |
| 129 | | | 1 | | | | | 1 | | 66 |
| 130 | | | | 1 | | | | 1 | | 68 |
| 131 | | | 1 | 1 | | | | 1 | | 70 |
| 132 | | | | | 1 | | | 1 | | 72 |
| 133 | | | 1 | | 1 | | | 1 | | 74 |
| 134 | | | | 1 | 1 | | | 1 | | 76 |
| 135 | | | 1 | 1 | 1 | | | 1 | | 78 |
| 136 | | | | | | 1 | | 1 | | 80 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 248 | | | | | | 1 | 1 | 1 | 1 | 240 |
| 249 | | | 1 | | | 1 | 1 | 1 | 1 | 242 |
| 250 | | | | 1 | | 1 | 1 | 1 | 1 | 244 |
| 251 | | | 1 | 1 | | 1 | 1 | 1 | 1 | 246 |
| 252 | | | | | 1 | 1 | 1 | 1 | 1 | 248 |
| 253 | | | 1 | | 1 | 1 | 1 | 1 | 1 | 250 |
| 254 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 252 |
| 255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 255.5 |

FIG. 8A

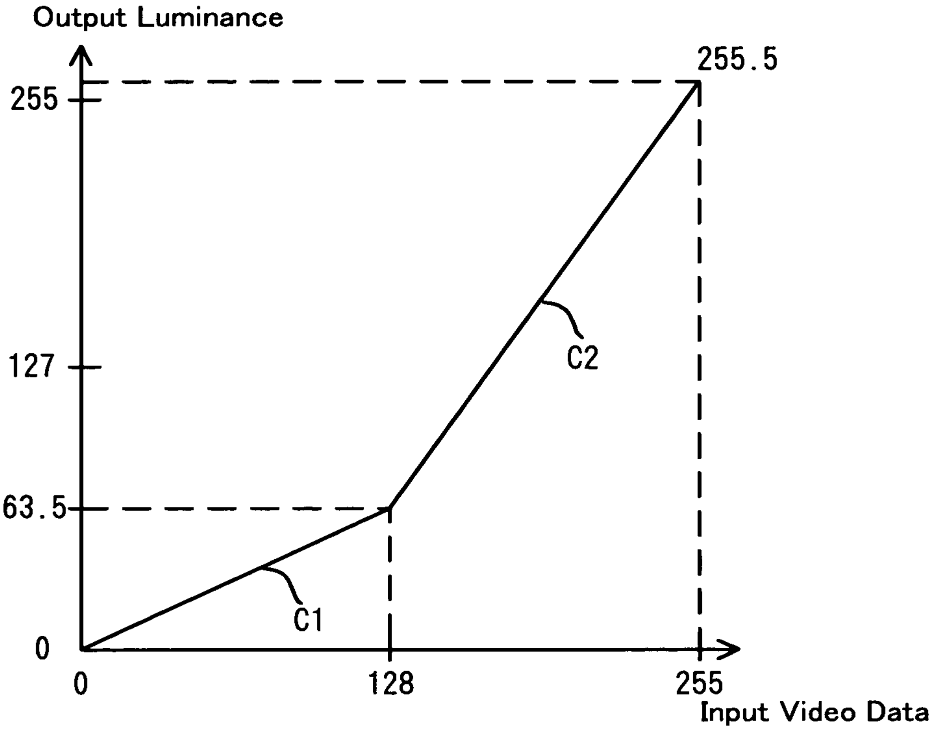

Output Luminance
255.5
255
127
63.5
0
C2
C1
0
128
255
Input Video Data

FIG. 8B

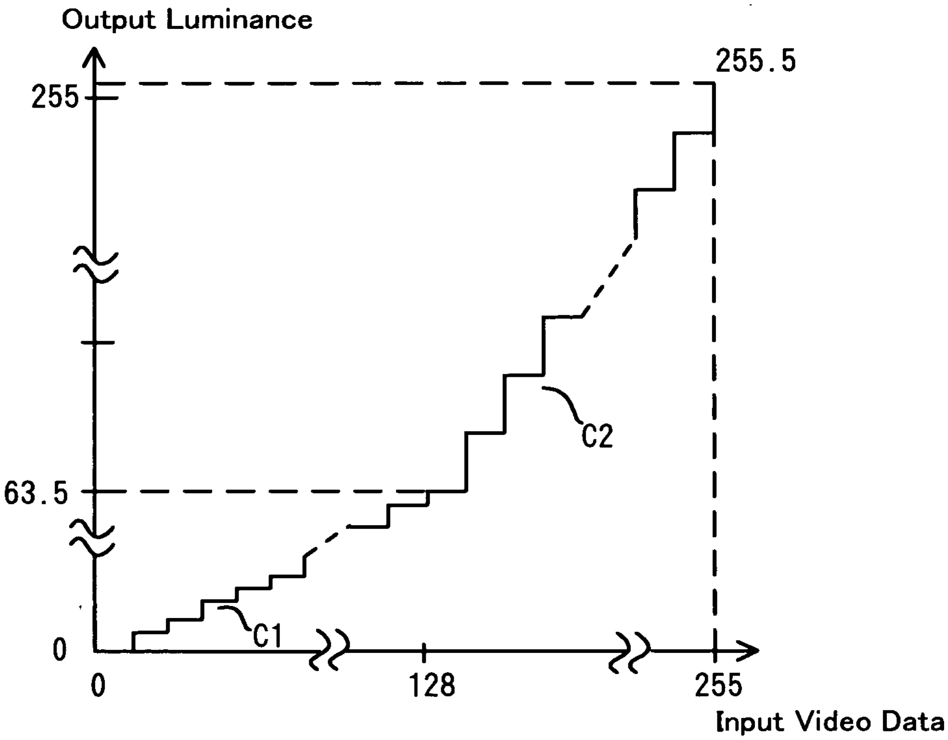

Output Luminance
255.5
255
63.5
0
C2
C1
0
128
255
Input Video Data

FIG. 9

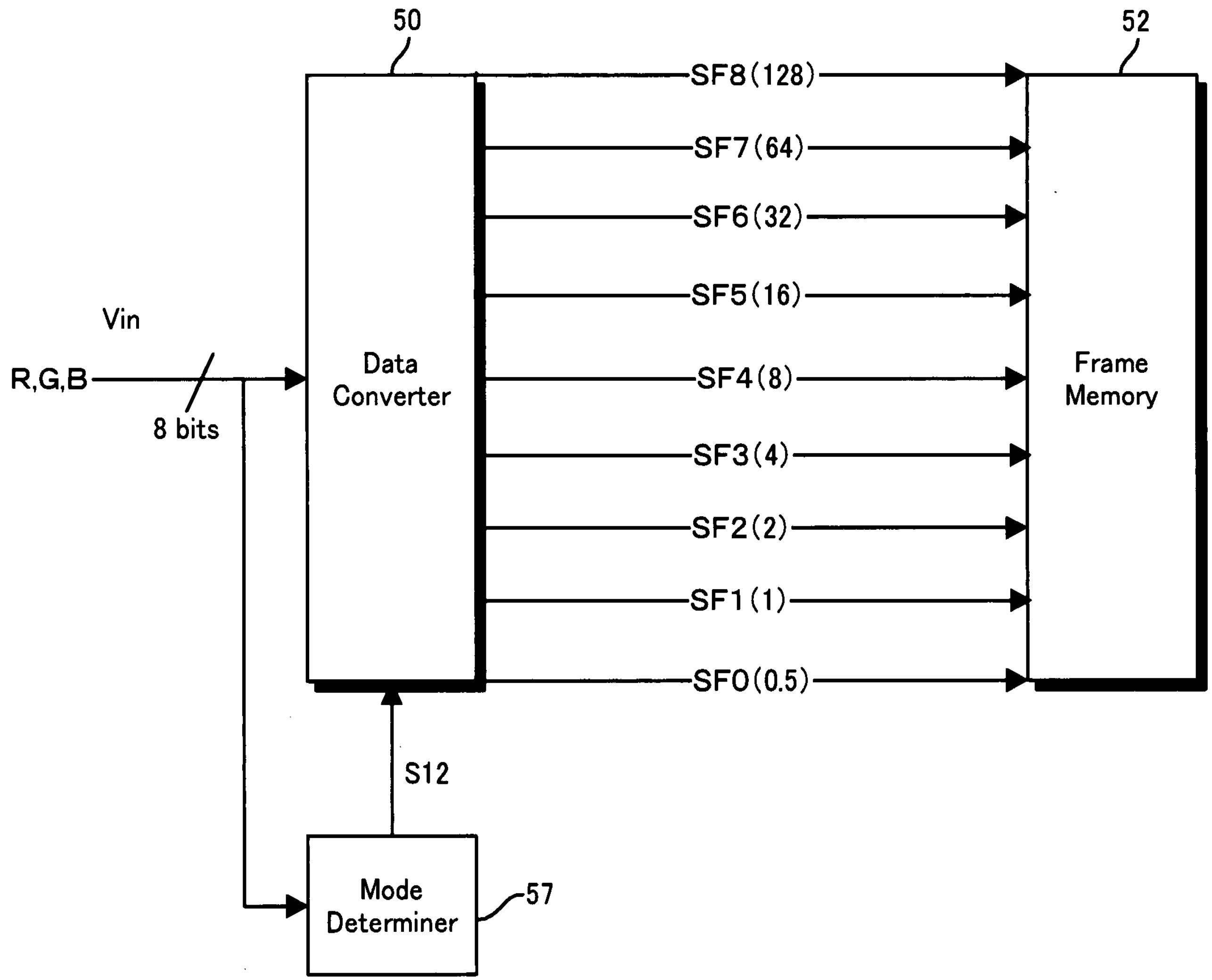

50
52
Vin
R,G,B
8 bits
Data Converter
Frame Memory
SF8(128)
SF7(64)
SF6(32)
SF5(16)
SF4(8)
SF3(4)
SF2(2)
SF1(1)
SF0(0.5)
S12
Mode Determiner
57

FIG. 10

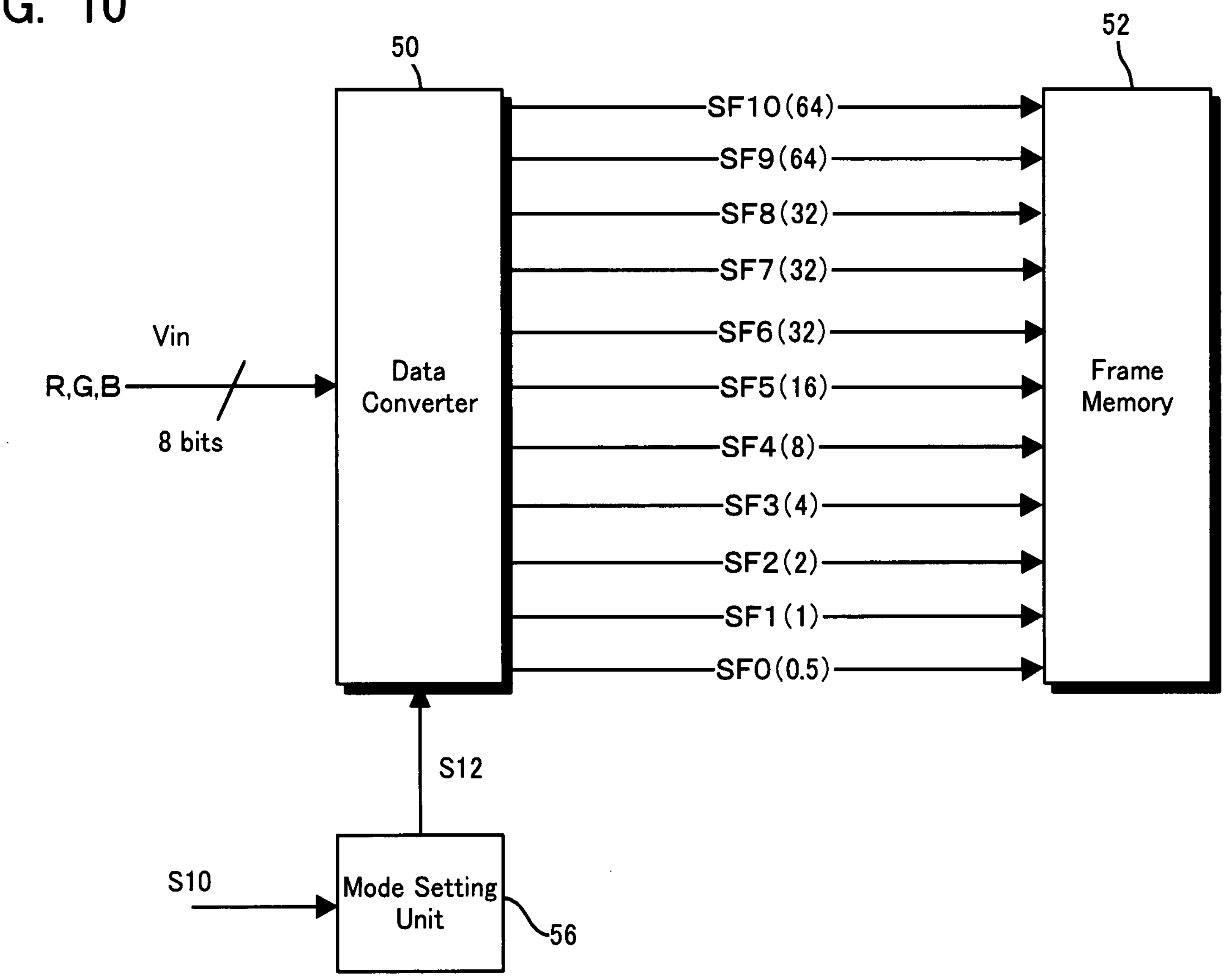

50
52
Vin
R,G,B
8 bits
Data Converter
Frame Memory
SF10(64)
SF9(64)
SF8(32)
SF7(32)
SF6(32)
SF5(16)
SF4(8)
SF3(4)
SF2(2)
SF1(1)
SF0(0.5)
S12
S10
Mode Setting Unit
56

FIG. 11

Conversion Table (2)

| Input Gray Scale | SF0 (0.5) | SF1 (1) | SF2 (2) | SF3 (4) | SF4 (8) | SF5 (16) | SF6 (32) | SF7 (32) | SF8 (32) | SF9 (64) | SF10 (64) | Luminance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | 0 |
| 1 | 1 | | | | | | | | | | | 0.5 |
| 2 | | 1 | | | | | | | | | | 1.0 |
| 3 | 1 | 1 | | | | | | | | | | 1.5 |
| 4 | | | 1 | | | | | | | | | 2.0 |
| 5 | 1 | | 1 | | | | | | | | | 2.5 |
| 6 | | 1 | 1 | | | | | | | | | 3.0 |
| 7 | 1 | 1 | 1 | | | | | | | | | 3.5 |
| 8 | | | | 1 | | | | | | | | 4.0 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 121 | 1 | | | 1 | 1 | 1 | 1 | | | | | 60.5 |
| 122 | | 1 | | 1 | 1 | 1 | 1 | | | | | 61.0 |
| 123 | 1 | 1 | | 1 | 1 | 1 | 1 | | | | | 61.5 |
| 124 | | | 1 | 1 | 1 | 1 | 1 | | | | | 62.0 |
| 125 | 1 | | 1 | 1 | 1 | 1 | 1 | | | | | 62.5 |
| 126 | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 63.0 |
| 127 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 63.5 |
| 128 | | | | | | | | 1 | 1 | | | 64 |
| 129 | | | 1 | | | | | 1 | 1 | | | 66 |
| 130 | | | | 1 | | | | 1 | 1 | | | 68 |
| 131 | | | 1 | 1 | | | | 1 | 1 | | | 70 |
| 132 | | | | | 1 | | | 1 | 1 | | | 72 |
| 133 | | | 1 | | 1 | | | 1 | 1 | | | 74 |
| 134 | | | | 1 | 1 | | | 1 | 1 | | | 76 |
| 135 | | | 1 | 1 | 1 | | | 1 | 1 | | | 78 |
| 136 | | | | | | 1 | | 1 | 1 | | | 80 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 248 | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 240 |
| 249 | | | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 242 |
| 250 | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 244 |
| 251 | | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 246 |
| 252 | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 248 |
| 253 | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 250 |
| 254 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 252 |
| 255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 255.5 |

FIG. 12

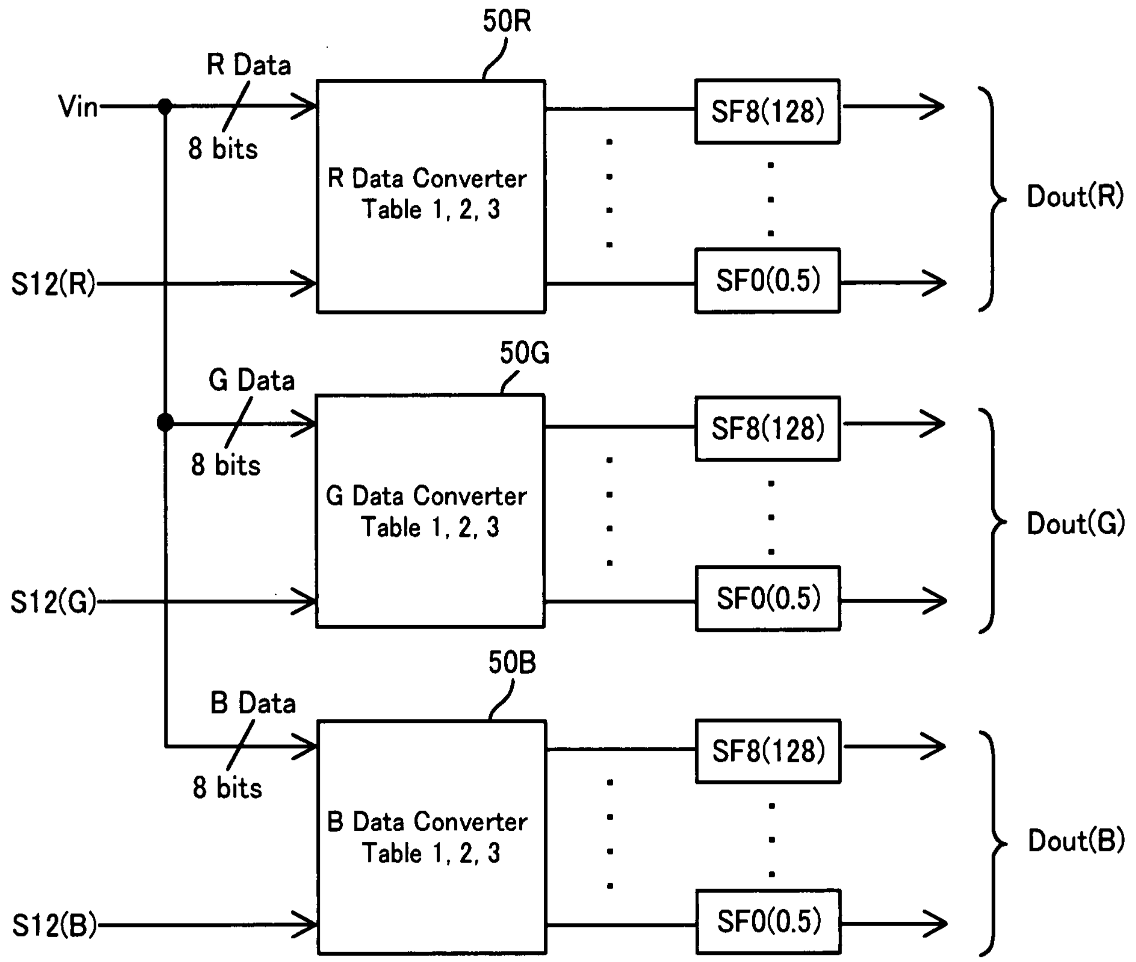

50R
R Data
8 bits
Vin
S12(R)
R Data Converter
Table 1, 2, 3
SF8(128)
SF0(0.5)
Dout(R)
50G
G Data
8 bits
S12(G)
G Data Converter
Table 1, 2, 3
SF8(128)
SF0(0.5)
Dout(G)
50B
B Data
8 bits
S12(B)
B Data Converter
Table 1, 2, 3
SF8(128)
SF0(0.5)
Dout(B)

FIG. 13

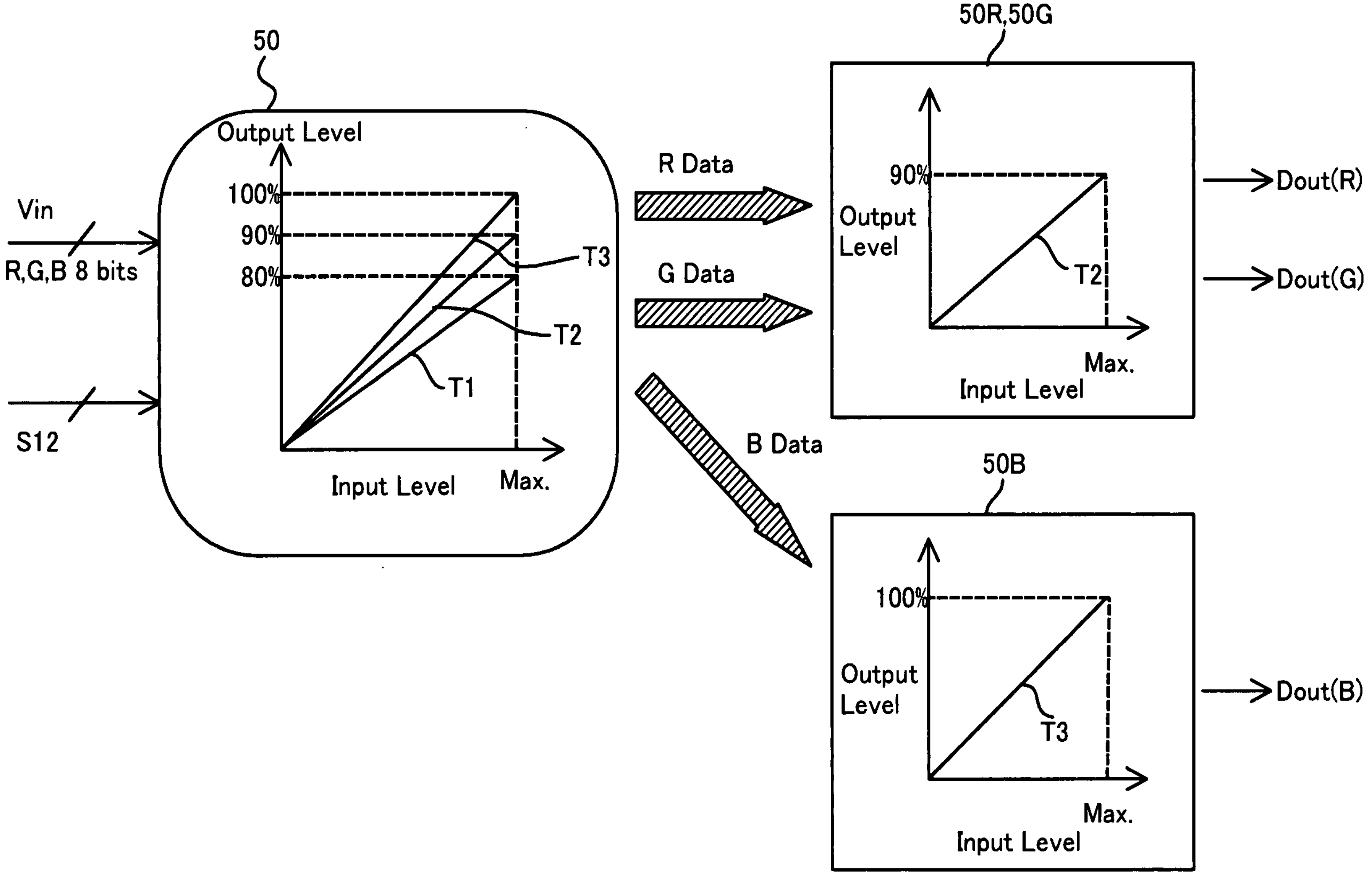
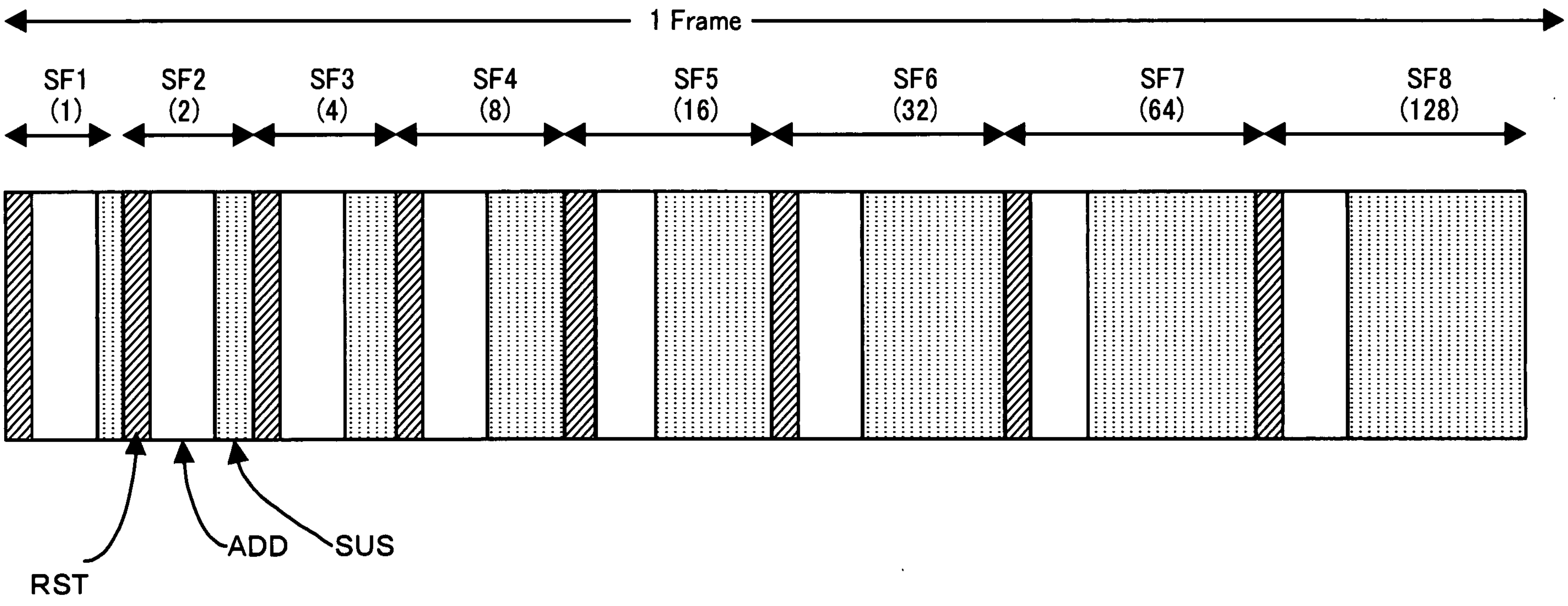

50
Output Level
100%
90%
80%
T3
T2
T1
Input Level
Max.
Vin
R,G,B 8 bits
S12
R Data
G Data
B Data
50R,50G
90%
Output
Level
T2
Max.
Input Level
Dout(R)
Dout(G)
50B
100%
Output
Level
T3
Max.
Input Level
Dout(B)

FIG. 14

Conventional Sub-frame System (8 Sub-frames)



# FIG. 15

Conventional Data Conversion Table

| Input Gray Scale | SF1 (1) | SF2 (2) | SF3 (4) | SF4 (8) | SF5 (16) | SF6 (32) | SF7 (64) | SF8 (128) | Luminance |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | 0 |
| 1 | 1 | | | | | | | | 1 |
| 2 | | 1 | | | | | | | 2 |
| 3 | 1 | 1 | | | | | | | 3 |
| 4 | | | 1 | | | | | | 4 |
| 5 | 1 | | 1 | | | | | | 5 |
| 6 | | 1 | 1 | | | | | | 6 |
| 7 | 1 | 1 | 1 | | | | | | 7 |
| 8 | | | | 1 | | | | | 8 |
| | | | | | | | | | |
| | | | | | | | | | |
| 121 | 1 | | | 1 | 1 | 1 | 1 | | 121 |
| 122 | | 1 | | 1 | 1 | 1 | 1 | | 122 |
| 123 | 1 | 1 | | 1 | 1 | 1 | 1 | | 123 |
| 124 | | | 1 | 1 | 1 | 1 | 1 | | 124 |
| 125 | 1 | | 1 | 1 | 1 | 1 | 1 | | 125 |
| 126 | | 1 | 1 | 1 | 1 | 1 | 1 | | 126 |
| 127 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 127 |
| 128 | | | | | | | | 1 | 128 |
| 129 | 1 | | | | | | | 1 | 129 |
| 130 | | 1 | | | | | | 1 | 130 |
| 131 | 1 | 1 | | | | | | 1 | 131 |
| 132 | | | 1 | | | | | 1 | 132 |
| 133 | 1 | | 1 | | | | | 1 | 133 |
| 134 | | 1 | 1 | | | | | 1 | 134 |
| 135 | 1 | 1 | 1 | | | | | 1 | 135 |
| 136 | | | | 1 | | | | 1 | 136 |
| | | | | | | | | | |
| | | | | | | | | | |
| 248 | | | | 1 | 1 | 1 | 1 | 1 | 248 |
| 249 | 1 | | | 1 | 1 | 1 | 1 | 1 | 249 |
| 250 | | 1 | | 1 | 1 | 1 | 1 | 1 | 250 |
| 251 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 251 |
| 252 | | | 1 | 1 | 1 | 1 | 1 | 1 | 252 |
| 253 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 253 |
| 254 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 254 |
| 255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 255 |

FIG. 16A

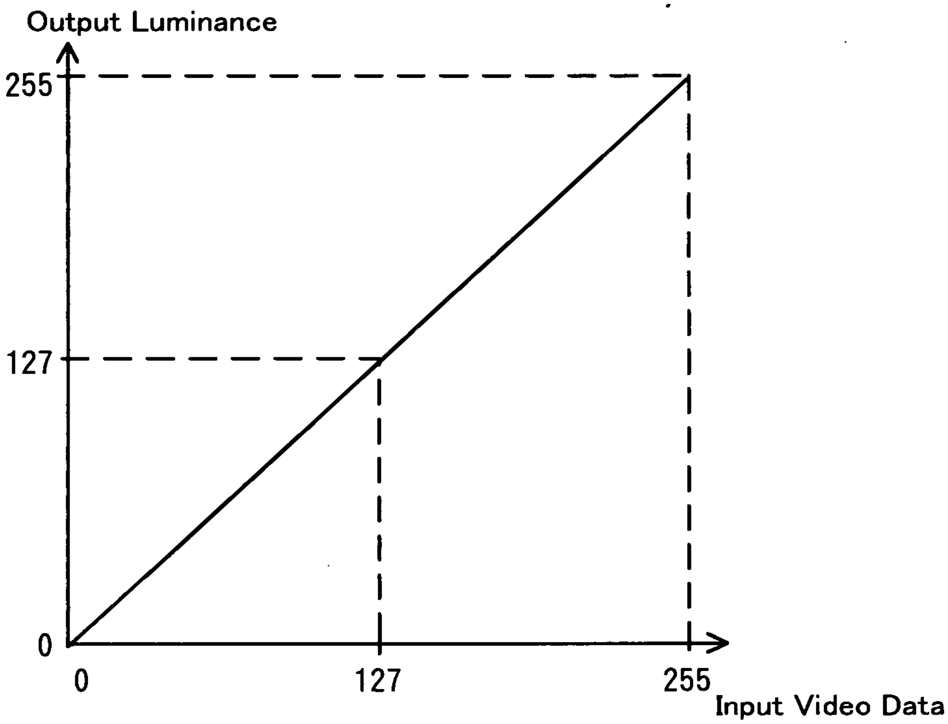


FIG. 16B